4 Chemical Bonding

For each question, choose the most suitable option and write the letter (**A**, **B**, **C** or **D**) in the brackets provided.

Level 1

1. Which of the following statements describes why atoms form bonds?
   - **A** To attain a noble gas electronic configuration
   - **B** To ensure that elements exist as compounds
   - **C** To ensure that all atoms have 8 electrons in their outermost shell
   - **D** To ensure that elements exist as molecules ( )

2. Which of the following is **true** of the bonds formed between carbon and oxygen atoms in carbon dioxide, CO_2?
   - **A** A carbon and an oxygen atom share 1 pair of electrons
   - **B** A carbon and an oxygen atom share 2 pairs of electrons
   - **C** An oxygen atom gains 1 electron from a carbon atom
   - **D** An oxygen atom gains 2 electrons from a carbon atom ( )

3. An ionic bond is formed when _____.
   - **A** electrons are shared between non-metals
   - **B** electrons are shared between non-metals and metals
   - **C** ions of opposite charges are attracted to each other
   - **D** ions of similar charges are attracted to each other ( )

4 Which statement is **true** when calcium atoms bond with fluorine atoms?
   - **A** Calcium atoms gain 2 electrons to form Ca^{2-} ions.
   - **B** Calcium atoms lose 2 electrons to form Ca^{2+} ions.
   - **C** Fluorine atoms gain 1 electron to form F^{+} ions.
   - **D** Fluorine atoms lose 1 electron to form F^{-} ions. ( )

5. Which of the following is **true** of an element with the electronic configuration 2, 8, 8, 2?
   - **A** It can gain 1 electron.
   - **B** It can share 2 electrons with sulfur.
   - **C** It forms ions with a charge of +2.
   - **D** It only reacts with metals. ( )

6. Figure 4.1 shows part of the periodic table.

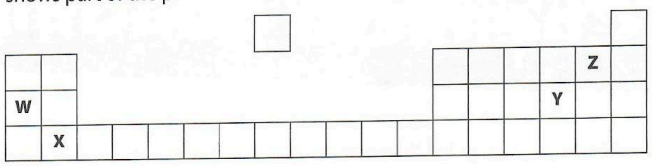

Figure 4.1

Which of the following statements about the listed elements is **incorrect**?

A **W** and **Y** can form ionic bonds.

B **W** and **Z** will form a compound, **WZ**.

C **X** and **Y** will form a compound, **XY**.

D **Y** and **Z** will form a compound, **YZ**, by sharing electrons. ( )

7. The structure of a covalent compound, QR_2, is as shown in Figure 4.2.

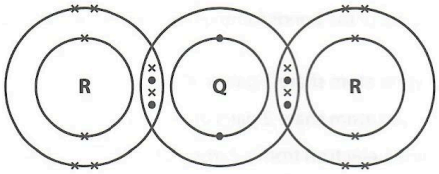

Figure 4.2

How many bonding and non-bonding electrons are there in this compound?

	Bonding Electrons	Non-bonding Electrons
A	4	7
B	4	14
C	8	14
D	8	22

( )

Level 2

8. Which of the following lists contains elements that exist as diatomic molecules at room temperature?

A Argon, helium, neon

B Bromine, hydrogen, nitrogen

C Chlorine, hydrogen, neon

D Helium, nitrogen, oxygen ( )

9. Figure 4.3 shows two compounds formed from elements **A**, **B**, **D** and **E**.

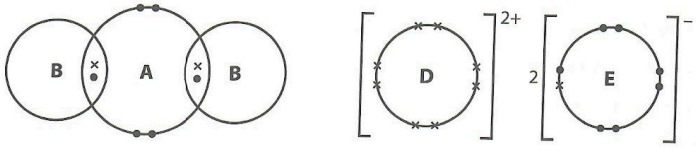

Figure 4.3

What of the following statements is **false**?

A A covalent compound is formed between elements **A** and **D**.

B A covalent compound is formed between elements **B** and **E**.

C An ionic compound is formed between elements **A** and **D**.

D An ionic compound is formed between elements **B** and **D**. ( )

10. The chemical formula of a nickel compound is $NiCO_3$. The chemical formula of aluminium sulfite is $Al_2(SO_3)_3$.

Which of the following is the chemical formula of nickel sulfite?

A NiSO

B $NiSO_3$

C $Ni(SO_3)_3$

D Ni_2SO_3 ( )

11. The electronic configuration of elements **A** and **B** are 2, 8, 8, 1 and 2, 8, 6 respectively.

Which of the following shows the type of bonding and the chemical formula of the compound formed between **A** and **B**?

	Type of Bonding	Chemical Formula
A	Covalent	A_2B
B	Covalent	**AB**
C	Ionic	A_2B
D	Ionic	**AB**

( )

Level 3

12. Which of the following compounds contains **both** ionic and covalent bonds?

A Copper(II) chloride

B Magnesium oxide

C Water

D Zinc nitrate ( )

13. Which of the following statements is **true** about the following particles?

F^- Ne Na^+

A They all contain more electrons than protons.

B They all contain more neutrons than protons.

C They all contain the same number of electrons.

D They all contain the same number of neutrons. ( )

14. Soda-lime is a compound containing silicon that can be used to make glass for food containers or bakeware. The structure of soda-lime is shown in Figure 4.4.

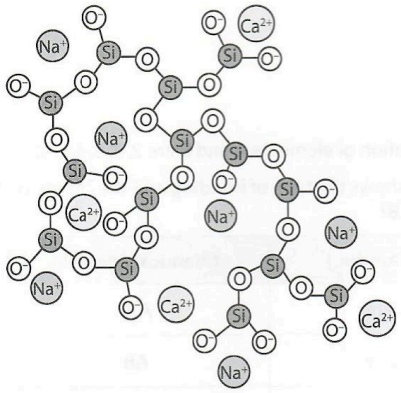

Figure 4.4

Which of the statements below is/are **true** about the bonds formed in soda-lime glass?

1 Some atoms share electrons in soda-lime glass.

2 Some oxygen atoms have gained electrons from sodium and calcium atoms in soda-lime glass.

3 Some oxygen atoms have gained electrons from some silicon atoms in soda-lime glass.

A 1 only

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only ( )

15. A student was given the structure of the following compound in Figure 4.5.

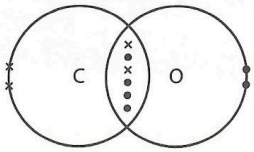

Figure 4.5

The student made the following observations.

1 Both atoms have attained the noble gas electronic configuration.

2 One of the bonds formed involves 2 electrons from the oxygen atom.

3 The name of the compound is carbon dioxide.

4 There are 3 bonds formed between the carbon and the oxygen atom.

Which of his observations are **correct**?

A 1, 2 and 3 only

B 1, 2 and 4 only

C 2, 4 and 3 only

D All of the above

( )